Academic Integration Activities

South Dakota Agriculture, Food and Natural Resources classes

August 2011

South Dakota Ag Ed Integration Project
2011 Integration Activities

Activity	Core Standard	AFNR Course standard
1	**11.R.3.1** Students can analyze and explain literary devices within text. • Recognize literary devices and communicate their effect within text: – personification	**Introduction to Agriculture, Food and Natural Resources** ITA3.1 Describe the major categories of natural resources in America. • Describe local natural resources.
2	**11.R.3.1** Students can analyze and explain literary devices within text. • Recognize literary devices and communicate their effect within text: – onomatopoeia	**Leadership and Personal Development** LPD 4.2 Employ public speaking skills to communicate an important agricultural message. • Research current agricultural issues to determine what information needs to be shared with the public. • Write a six to eight minute speech.
3	**11.R.4.1** Students can analyze a text within cultural, geographical, and historical context. • Recognize the connection between the written work and the circumstances that produced it.	**Fundamental Plant Science** FPS 1.1 Investigate articles about plant breeding and its impact on the world • Investigate the development of new techniques of plant breeding across the United States. • Examine the history of plant breeding and how it has impacted the successfulness of plant genetics. • Analyze the influence of plant breeding and how it affects the rest of the world.
4	**11.R.2.1** Students can analyze how diction affects the interpretation of text. • Identify dialect (a particular variety of language spoken in one place by a distinct group of people) • Determine how slang, colloquialisms, and dialect impact meaning	**Horticulture** H.1.1 Write a description for a plant species.
5	**9-12.S.1.2** Students are able to compare multiple one-variable data sets, using range, interquartile range, mean, mode, and median.	**Fundamental Animal Science** AN5.1 Recognize optimum performance for a given animal species. • Identify reasons why some animals perform better than others. Evaluate sire performance records
6	**9-12.G.1.2** Students are able to identify and apply relationships among triangles.	**Ag Metal Fabrication Technology** AMF1.3 Create plans for project construction. • Use scale measurement and dimension to develop plans and sketches for a shop project.

7	**9-12.N.2.1** Students are able to add, subtract, multiply, and divide real numbers including integral exponents.	**Ag Power Technology** APT 3.9 Illustrate various electric motor types, operation and maintenance. • Calculate problems using Ohm's law.
8	**9-12.G.2.3** Students are able to use proportions to solve problems.	**Fundamental Ag Mechanics** FAM 3.1 Create sketches of agricultural equipment. • Utilize drawing techniques to develop a simple sketch. • Use scale measurement and dimension to develop simple plans and sketches.
9	**9-12.G.1.1** Students are able to apply the properties of triangles and quadrilaterals to find unknown parts.	**Fundamental Ag Structures Technology** Ag S 4.1 Assemble components of a structure • Construct a wall. • Construct a floor joist. • Erect a rafter.
10	**9-12.S.2.2** Students are able to predict outcomes of simple events using given theoretical probabilities.	**Natural Resources** NR 1.3 Examine planning data to determine natural resource status • Collect data to determine resource availability and health of a specific natural resource. • Analyze resource inventory and population studies of natural resources.
11	**9-12.A.3.2** Students are able to distinguish between linear and nonlinear models.	**Wildlife and Fisheries** WF 1.1 Apply knowledge of natural resource components to the management of wildlife and fish. • Dramatize predator and prey population relationships. • Illustrate the interdependence of organisms within an ecosystem.
12	**9-12.N.1.1** Students are able to identify multiple representations of a real number. • Represent rational and irrational numbers in different forms.	**Agribusiness Sales and Marketing** ABSM 3.1 Apply reading comprehension, writing and math skills in inventory management. • Calculate product margin (specifically net profit). • Interpret inventory control systems
13	**9-12.A.1.1** Students are able to write equivalent forms of algebraic expressions using properties of the set of real numbers. • Evaluate algebraic expressions.	**Agribusiness Entrepreneurship** E 1.2 Develop management skills necessary to accomplish general business activities. • Illustrate basic economic concepts to a given set of financial situations including opportunity cost, supply and demand and diminishing returns.
14	**9-12.N.3.2** Students are able to select alternative computational strategies and explain the chosen strategy.	**Agriscience** AS2.2 Demonstrate plant cultural procedures. • Demonstrate proper seeding practices.

15	**9-12.G.2.2** Students are able to reflect across vertical or horizontal lines, and translate two-dimensional figures. • Identify lines of symmetry.	**Introduction to Agriculture, Food and Natural Resources** ITA 5.1 Explain functions and physiology of cells and seeds. • Summarize the cellular structure of plants. • Explain the structure and kinds of seeds. • Summarize the process of seed germination.

These examples prepared for the Office of Curriculum and Career and Technical Education, South Dakota Department of Education, by Vivayic. August 2011.

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #1

Introduction to Agriculture, Food and Natural Resources students explain personification within their own written text about natural resources to communicate the effect of such literary devices.

1. Ag Standard

Introduction to Agriculture, Food and Natural Resources, ITA3.1: Describe the major categories of natural resources in America.
>>Describe local natural resources.

2. Academic Standard

11.R.3.1: Students can analyze and explain literary devices within text.
>>Recognize literary devices and communicate their effect within text: **personification**

3. Background Information

Personification: giving human qualities to animals or objects.
Example: *The leaves whistled in the wind.*
→The act of whistling is a human quality that was given to the leaves.

4. Example in Context

Example: Write an accurate sentence that uses personification and explain the use of the literary device.

Choose one natural resource term from list A and one verb from list B. Write a descriptive sentence about our natural resources using personification.

List A	List B
Water	dreams
Natural Gas	reminds
Cotton	teaches
Wheat	listens
Trees	dances
Coal	looks
Petroleum	guides

Words chosen: water dances

Extend those words into a descriptive sentence:
Answer Part 1: Lake Oahe's water dances under the bright sunlight.

Answer Part 2: The act of dancing is a human quality that was given to the water.

5. Guided Practice Exercise

Example: Write an accurate sentence that uses personification and explain the use of the literary device.

Choose one natural resource term from list A and one verb from list B. Write a descriptive sentence about our natural resources using personification.

List A	List B
Water	dreams
Natural Gas	reminds
Cotton	teaches
Wheat	listens
Trees	dances
Coal	looks
Petroleum	guides

Words chosen: cotton dreams

Extend those words into a descriptive sentence:
Answer Part 1: The fields of cotton dream of the fine clothing items it will someday become.

Answer Part 2: The act of dreaming is a human quality that was given to the cotton fields.

6. Independent Practice Exercises

Example: Write an accurate sentence that uses personification and explain the use of the literary device.

Choose one natural resource term from list A and one verb from list B. Write a descriptive sentence about our natural resources using personification.

List A	List B
Water	dreams
Natural Gas	reminds
Cotton	teaches
Wheat	listens
Trees	dances
Coal	looks
Petroleum	guides

Words chosen: coal reminds

Extend those words into a descriptive sentence:
Answer Part 1: The abiotic natural resource of coal reminds consumers to be energy efficient.

Answer Part 2: The act of reminding is a human quality that was given to the natural resource coal.

7. Notes

Students could also search for examples of personification in printed materials such as newspaper articles, agricultural magazines or classroom textbooks.

Another variation could be that teachers provide worksheets that have paragraphs related to class content. Students would analyze the paragraphs to find examples of personification and then explain the meaning of the text.

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #2

Leadership and Personal Development students analyze and explain onomatopoeias within their own written text related to current agricultural issues to communicate the effect of such literary devices.

1. Ag Standard

Leadership and Personal Development, LPD 4.2: Employ public speaking skills to communicate an important agricultural message.

- Research current agricultural issues to determine what information needs to be shared with the public.
- Write a six to eight minute speech.

2. Academic Standard

11.R.3.1: Students can analyze and explain literary devices within text.

- Recognize literary devices and communicate their effect within text: **onomatopoeia**

3. Background Information

Onomatopoeia: literary device in which a word or expression mimics the sound it represents

Example: the "quack" of a duck or the "meow" of a cat

Examples: buzz, zoom, honk, burp, crunch, moo, hiss, gong, thud, splash, zip, creak, slurp

Writers should avoid over-use of onomatopoeias.

4. Example in Context

Teaching Example: First, randomly assign or have students choose an agricultural topic and set of onomatopoeias from the lists below. Then have students research current ag issues related to that topic. Using 3 of the 6 onomatopoeias write informational sentences about a current agricultural issue.

*Midwest Weather Conditions: boom, splash, pitter patter, squish, rumble, rattle
*Animal Agriculture- Rights and Welfare: meow, swish, hiss, quack, croak, wham
*Agricultural Mechanics and Metal Fabrication: clank, tick tock, zip, honk, clink, hum
*Natural Resources Conservation and Management: dash, gasp, ouch, buzz, yahoo, crash,
*Food Science and Production: crunch, snap, swoop, splat, burp, oink

Topic Chosen: Midwest Weather Conditions
Current Information found in Research: summer flooding, heat wave, high temperatures, tornadoes
Onomatopoeia to Incorporate: boom, splash, pitter patter, squish, rumble, rattle

Combine current issue with onomatopoeias. Sample of student's writing:

"The spring and summer of 2011 will be remembered for the tremendous tornadoes and flooding that occurred. *Boom, rumble, splash*! Midwesterners from several states have grown accustomed to the growl of storms."

Answer: This writing sample describes facts about Midwest weather conditions while incorporating the onomatopoeias *rumble*, *boom* and *splash*.

5. Guided Practice Exercise

Topic Chosen: Animal Agriculture- Rights and Welfare
Current Information found in Research: livestock overheating in hot weather
Onomatopoeias to Incorporate: meow, swish, hiss, quack, croak, wham

Student Writing Sample:
"Farm and ranching operations in South Dakota paid close attention to the excessive heat wave that blanketed the state. The high temperatures hit livestock with a *wham*! It was important for producers to keep animals cool using misting systems and the *swish* of fans. Livestock owners concerned for the welfare of their animals took extra precautions to avoid the sun's *sizzle*."

Answer: The writing sample describes a weather-related welfare condition that affected agriculturists in South Dakota while utilizing onomatopoeias *wham*, *swish* and *sizzle.*

6. Independent Practice Exercises

Topic Chosen: Agricultural Mechanics and Metal Fabrication
Current Information found in Research:
Onomatopoeias to Incorporate: clank, tick tock, zip, honk, clink, hum

Student Writing Sample:
"FFA offers an Agricultural Mechanics contest each year. Participants in the Career Development Events may be required to identify engine components, sharpen a chisel or use power tools. Students may find causes of the *clink* or *clank* sounds coming from equipment and machines. Depending on knowledge and experience, some FFA members *zip* right through the contest."

Answer: In this writing sample a student describes the Ag Mechanics CDE event while including onomatopoeias *clink, clank*, and *zip*.

7. Notes

Alternative teaching method: When students write speeches for class, they could be required to incorporate literary devices such as onomatopoeias.

Alternative teaching method: Students could write short advertising jingles for agricultural companies that use onomatopoeias. (Ex: Rice Krispies: Snap! Crackle! Pop!)

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #3

Fundamental Plant Science students will be able to analyze a text within cultural, geographical, and historical content to communicate the effect of such literary devices.

1. Ag Standard

Fundamental Plant Science, FPS 1.1: Investigate articles about plant breeding and its impact on the world.

- Investigate the development of new techniques of plant breeding across the United States.
- Examine the history of plant breeding and how it has impacted the successfulness of plant genetics.
- Analyze the influence of plant breeding and how it affects the rest of the world.

2. Academic Standard

11.R.4.1 Students can analyze a text within cultural, geographical, and historical context.

- Recognize the connection between the written work and the circumstances that produced it.

3. Background Information

The over-riding goal of analyzing writing is to demonstrate some new understanding of the text.

How to Analyze Text

a. Read or reread the text with specific questions of mind.
b. Organize basic ideas, events, and names.
c. Think through your personal reaction to the writing.
d. Identify and consider the most important ideas.
e. Return to the text to locate specific evidence and passages related to the major ideas.
f. Identify a thesis or topic sentence indicating a basic observation or assertion about the text.
g. Discuss what happens in the passage and why it is significant to the work as a whole.
h. Consider what is said – particularly the ideas that are expressed.
i. Assess how it is said, considering how word choice, the order of ideas, and sentence structure contribute to the meaning of the passage.

4. Example in Context

Consider these questions:

a. What thoughts/feelings does the author have regarding the article's topic?
b. What example does the author make and why?
c. How has the history of plant breeding been significant to the plant science industry?

Despite the poor understanding of the process, plant breeding was a popular activity. Gregor Mendel himself, the father of genetics, was a plant breeder, as were some of the leading botanists of his time. Mendel's 1865 paper (http://www.MendelWeb.org/Mendel.html) explaining how dominant and recessive alleles could produce the traits we see and could be passed to offspring was the first major insight into the science behind the art. The paper was largely ignored until 1900, when three scientists working on breeding problems rediscovered it and publicized Mendel's findings.

Major advances in plant breeding followed the revelation of Mendel's discovery. Breeders brought their new understanding of genetics to the traditional techniques of self-pollinating and cross-pollinating plants.

Corn breeders, particularly, tried numerous strategies to capitalize on the insights into heredity. Corn plants that had traditionally been allowed to cross-pollinate freely were artificially self-pollinated for generations and crossed to other self-pollinated lines in an effort to achieve a favorable combination of alleles. The corn we eat today is the result of decades of this strategy of self-pollination followed by cross-pollination to produce vigorous hybrid plants.

Answer:

Reading Standard

a. The author views that the way plant breeding came across was not an "accident," but and educated hypothesis. The author uses wording that is accurate and improving on today's cross-pollination.
b. The author uses the example of corn breeders, in which they have taken the insights of self-pollination and artificially self-pollinated these types of corn. It gives an accurate description of how they look back at Mendel's findings to generate new hybrid plants.

Ag Standard

c. This article talks about the major advances in plant breeding after Mendel's discovery. It started the new understanding self and cross pollination and how breeders can use it to their advantage.

5. Guided Practice Exercise

Consider these questions:

a. What cultural issues are brought up in this article?
b. How is today's plant breeding affecting our future?

May 31, 2011—Seth Murray, a corn breeder at Texas A&M, and his team of graduate students are breeding new hybrids of blue and red corn lines and studying their antioxidant potential. Antioxidants have desirable health benefits and the research could lead to viable new corn varieties with high antioxidant content. "This research is really exciting because if we can increase antioxidants in our diet hopefully that will lead to a healthier population, a healthier planet," says Murray.

Reading Standard

a. Our culture as a whole is suffering from health risks. Seth Murray and his team would like to make a variety of corn that has more antioxidants, which has beneficial health benefits.

Ag Standard

b. New varieties of corn are always being bred. If plant breeders are trying to make healthier varieties, it affects how people across the nation will see the benefit of that breed. It also increases the chance of a healthier lifestyle for a person.

6. Independent Practice Exercises

Consider these questions:

a. Who is the intended audience?
b. What is the purpose for writing this article?
c. What does this article indicate about plant breeding and its affect on other nations?

By 2050, the number of humans is expected to exceed 9 billion. Providing food, feed fuel and fiber for this enormous population is an ominous challenge facing humankind, without significant addition of new arable lands, challenges of changing weather patterns and decreased quantity and quality of fresh water. Plant breeders are the key to developing superior crops to meet these world needs. "There needs to be a sense of urgency around plant breeding as an important contributor to managing all kinds of global change, which is coming to us with increasing velocity," says Donn Cummings, global breeder sourcing lead for Monsanto. "While these challenges are daunting and complex, agricultural innovation delivered with the aid of plant breeding innovation remains central to our well being."

Reading Standard

a. The population of humans that are not experts in plant breeding.
b. The purpose of this article is to show that plant breeders are the key to meeting the world's needs with significant challenges including population rise and decrease in land and water usage.

Ag Standard

c. Without the innovations that plant breeders are expected to develop, we might see a bigger challenge with the growing population to provide food, feed, and fiber.

7. Notes

Students could also research for examples of plant breeding in articles that does not deal with corn. These can be found on the internet, magazines, historical documents, etc.

Another variation could be that teachers provide worksheets that have one long article instead of many different articles, as this example does.

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #4

Horticulture students will be able to understand how slang and colloquialisms impact the meaning of plant descriptions from forms of text.

1. Ag Standard

Horticulture, H. 1.1: Write a description for a plant species.

2. Academic Standard

11.R.2.1: Students can analyze how diction affects the interpretation of text.

- Identify dialect (a particular variety of language spoken in one place by a distinct group of people)
- Determine how slang, colloquialisms, and dialect impact meaning.

3. Background Information

Informal language, such as slang and colloquialisms, can affect the meaning of text because using slang and colloquialisms can indicate who wrote the text and where the text was written.

Slang is generally defined as language peculiar to a particular group (e.g. teenagers, surfers, soldiers, etc.)

A colloquialism is a word or phrase that is typically used in a certain area or region(i.e. “pop” in the Midwest vs. “soda” on the coasts vs. “coke” in the South.)

4. Example in Context

Read this description of a plant:

Pinktopia, an Easy Elegance rose, packs masses of dreamy medium pink blooms against dark green leaves. Pinktopia’s new growth is a stunning red. It makes a great low-maintenance accent plant or hedge. Recurrent bloom cycle. Grows 4 feet tall and 3 feet wide. Zones 4–9.

Use these questions to interpret:

a. Where was the informal language used?
   -Dreamy.
b. Is this slang or colloquialism?
   -Slang, because it is a language use by a group instead of a region.
c. How does this wording affect our interpretation of the plant description?
   -Many answers.

5. Guided Practice Exercise

Read this description of a plant:
For sheer carnal gorgeousness, no other temperate-climate flower even comes close. Of course, if you're used to looking at things with the cold, steely eye of reason. Oriental poppies reveal some flaws: they bloom early and all too briefly: the taller kinds are apt to flop: and after blooming, their foliage goes into a prolonged and hideous decline before disappearing altogether.

Use these questions to interpret:

a. Where was the informal language used?
   -Steely eye of reason.
b. Is this slang or colloquialism?
   -Colloquialism, because it is a language use by a region instead or a particular group.
c. How does this wording affect our interpretation of the plant description?
   -Many answers.

6. Independent Practice Exercises

1. Identify three slang words or phrases that would describe a plant species. Identify the group that would use that slang word or phrase.
2. Identify two colloquialisms that are from two different geographical regions that would help describe a plant species.
3. Write one description of a plant using one of the slang words in your list and write another description of a plant using one of the colloquialisms in your list.

7. Notes

Students could also search for examples of slang and colloquialisms in magazines or the internet.

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #5

Fundamental Animal Science students use data set comparisons to evaluate sire performance records.

1. Ag Standard

Fundamental Animal Science, AN5.1: Recognize optimum performance for a given animal species.

- Identify reasons why some animals perform better than others. Evaluate sire performance records (EPD's, ratios, pedigree and carcass data).

2. Academic Standard

9-12.S.1.2: Students are able to compare multiple one-variable data sets, using range, interquartile range, mean, mode, and median.

3. Background Information

Interquartile Range: the distance between the 25th percentile and the 75th percentile
Range: difference between the largest and smallest values
Mean: the average value
Median: the middle value
Mode: the value repeated more than any other (can be more that one)

4. Example in Context

Scenario: The Jacobson Ranch runs a cow/calf operation and a feedlot. They finish the calves on the ranch and sell them for market. Once processed, Mr. Jacobson reviews the carcass data to evaluate the bulls they used as sires the previous year. This year's data shows a consistent trend of smaller than average rib eye area (REA). Mr. Jacobson has decided to purchase a new bull in hopes correcting the issue.

Which bull produced calves with the highest average REA? (mean)
Half of the calves produced by each bull have a REA of _____ or more. (median)
List the range of REA's for each bull.

Based on the information above, choose the best bull for Mr. Jacobson. Why? Which pieces of information were most useful in making your decision?

	Calf 1	Calf 2	Calf 3	Calf 4	Calf 5	Calf 6	Calf 7	Calf 8	Calf 9	Calf 10	Calf 11
Bulls											
Thunder	16.4	16.8	12.7	14.6	18.7	17.7	17.2	14.9	17.4	13.6	12.8
Precision	17.1	18.0	15.5	15.2	15.9	16.6	16.1	15.5	14.9	17.0	15.5

Answer:

	Calf 1	Calf 2	Calf 3	Calf 4	Calf 5	Calf 6	Calf 7	Calf 8	Calf 9	Calf 10	Calf 11	Mean	Median	Range
Bulls														
Thunder	16.4	16.8	12.7	14.6	18.7	17.7	17.2	14.9	17.4	13.6	12.8	15.7	16.4	6
Precision	17.1	18	15.5	15.2	15.9	16.6	16.1	15.5	14.9	17	15.5	15.9	16.1	3.1

Best Bull: Precision because the average is higher. Range is also important because a large range could skew an average. In this case, Precision also had the smaller range as well.

5. Guided Practice Exercise

Scenario: The Sanderson ranch sells their young calves to a backgrounder shortly after weaning them. The calves are sold by the pound, so a high weaning weight is desirable. Recently, one of their top bulls was injured and they are looking for a replacement.

Use the data provided in the table below to determine the following:

Which bull produced calves with the highest average weaning weight? (mean)
Half of the calves produced by each bull have a weaning weight of _____ or more. (median)
List the range of weaning weights for each bull.

Weaning Weight:	Calf 1	Calf 2	Calf 3	Calf 4	Calf 5	Calf 6	Calf 7	Calf 8	Calf 9	Calf 10	Calf 11
Bulls											
T-Rex	540	550	495	535	575	560	560	530	545	570	595
Solid Bet	485	625	515	530	540	520	540	495	515	555	575

Answer:

Weaning Weight:	Calf 1	Calf 2	Calf 3	Calf 4	Calf 5	Calf 6	Calf 7	Calf 8	Calf 9	Calf 10	Calf 11	Mean	Median	Range
Bulls														
T-Rex	540	550	495	535	575	560	560	530	545	570	595	550.5	560	100
Solid Bet	485	625	515	530	540	520	540	495	515	555	575	535.9	520	140

T-Rex would be the best bull for the Sanderson Ranch because it has the higher average and a low range.

6. Independent Practice Exercises

Scenario: Flavor J Ranch purchases backgrounded calves to finish out and sell to packers. The feedlot manager uses yield grade data to determine how efficient they were in maximizing their return in investment on feed and the cattle themselves. He also uses the data to determine which sires they want to look for in the calves they purchase. The following yield grade data was available for calves from two bulls that sired calves in this last set of finished cattle.

Use the data provided in the table below to determine the following:

Which bull produced calves with the lowest average yield grade? (mean)
Half of the calves produced by each bull have a yield grade of _____ or less. (median)
List the range of yield grades for each bull.

Yield Grade	**Calf 1**	**Calf 2**	**Calf 3**	**Calf 4**	**Calf 5**	**Calf 6**	**Calf 7**	**Calf 8**	**Calf 9**	**Calf 10**	**Calf 11**
Bulls											
Boris	2.4	3.3	2.8	4.0	3.5	3.6	2.9	3.8	3.3	4.1	3.2
Ajax	3.6	3.1	3.0	2.8	2.6	3.0	2.4	2.9	3.8	2.6	3.2

Answer:

Yield Grade	Calf 1	Calf 2	Calf 3	Calf 4	Calf 5	Calf 6	Calf 7	Calf 8	Calf 9	Calf 10	Calf 11	Mean	Median	Range
Bulls														
Boris	2.4	3.3	2.8	4	3.5	3.6	2.9	3.8	3.3	4.1	3.2	3.4	3.3	3.3
Ajax	3.6	3.1	3	2.8	2.6	3	2.4	2.9	3.8	2.6	3.2	3	3	2.6 and 3

Boris would be the best choice as he has a higher average. While his range is greater than Ajax, it's not by enough to make a difference.

7. Notes

None.

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #6

Ag Metal Fabrication students use knowledge of similarity in triangles to help in the design and construction of metal projects.

1. Ag Standard

Ag Metal Fabrication Technology, AMF1.3: Create plans for project construction.

- Use scale measurement and dimension to develop plans and sketches for a shop project.

2. Academic Standard

9-12.G.1.2: Students are able to identify and apply relationships among triangles.

- Similarity Theorems

3. Background Information

Angle/side similarities in triangles can be useful knowledge in project construction especially when building two versions of the same plans – with one larger than the other.

The following three criteria are sufficient to prove that a pair of triangles is similar. The first two state that if triangles have the same shape (AA criterion) then they are similar, and that if they are to scale (SSS criterion) then they are similar. The third criterion, SAS, combines some of the information used by each of the first two.

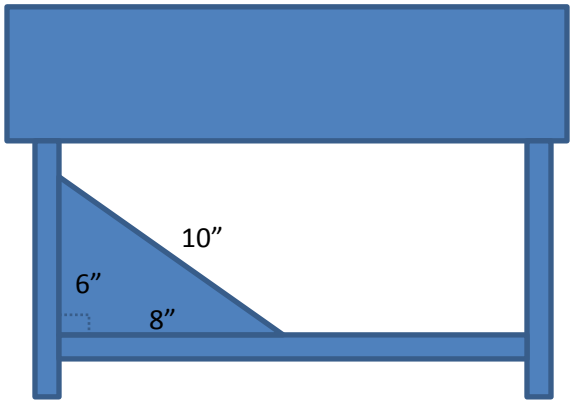
AA: if two triangles have two corresponding pairs of angles with the same measure then they are similar. Sometimes this criterion is also referred to as AAA because equality across triangles of two angles implies equality of the third. This criterion means that if a triangle is copied to preserve the shape, then the copy is to scale.

SSS (Three sides proportional): If the ratio of corresponding sides of two triangles does not depend on the pair of corresponding sides chosen, then the triangles are similar. This means that any triangle copied to scale is also copied in shape.

SAS (Ratio of two sides, included angle): if two sides in a triangle are proportional to two corresponding sides in another triangle, and the angles included between these sides have the same measure in each triangle, then the triangles are similar. This means that to enlarge a triangle, it is sufficient to copy one angle, and scale just the two sides that form the angle.

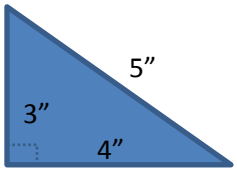
4. Example in Context

Scenario:
You are building metal feed bunks or calves that you want to be about two-thirds the size of regular feed bunks to make it easier for calves to feed from. You are using a regular-sized feed bunk as your template. A brace in the bunk leg measures the following:

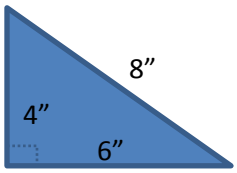


You have cut out two triangles from sheet metal and are trying to remember which is supposed to be the one that is similar to the one in the regular sized bunk. Which is it?

#1



#2

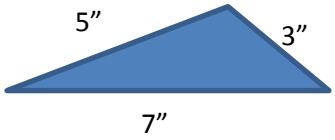


Which similarity theorem did you use to make your choice – AA, SSS, SAS?

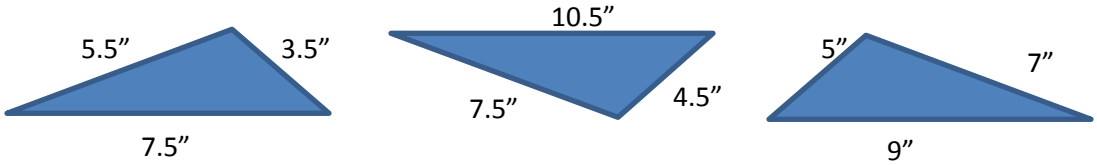
Answer:
Triangle #1 is the similar triangle to that in the regular sized feed bunk. You could use either the SSS or SAS theorems. SSS works because the ratio (2:1 in this case) of all three sides is the same 10:5, 6:3, and 8:4. SAS work because there is a right angle in the triangles and you can use the ratio of the sides on each side of this right angle to determine similarity – 6:3 on one side of the right angle and 8:4 on the other (both are 2:1 ratios).

5. Guided Practice Exercise

Scenario:
You are trying to build a bale feeder that is slightly larger than one you are using as a model. One of the pieces on the bale feeder is a triangle of sheet metal with the following dimensions:



You have found three triangles of sheet metal in the cut metal pile that look kind of like your model triangle and are just a bit bigger. Using one of the similarity theorems, determine which of the triangles you've found is similar to the triangle from the model bale feeder,

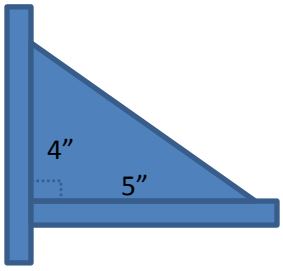


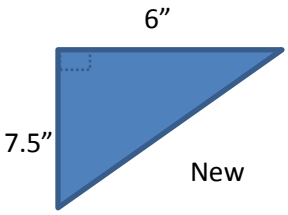
Answer: The middle triangle is the only one similar to the original triangle. The SSS theorem is the only one that can be used in this situation as we don't know any of the angles of the triangles, so we have to rely on finding the ratio of each of the corresponding sides.

6. Independent Practice Exercises

Scenario:
You are reinforcing the frame of a stock trailer. A piece of sheet metal has been cut to reinforce one of the back corners. A similar triangle is needed for the front corner. You tell your project partner to cut a similar triangle, but 1.5 times as big as the original. The image on the left is the original. The image on the right is what your partner cut out. Is the new triangle similar to the original? How can you tell?

Original





Answer: Yes. The new triangle is similar. You can tell because of the SAS theorem. You have a right angle and the sides on each side of that angle. The two sides are each 1.5 times as long (same ratio) as the original making this a similar triangle.

7. Notes

If you use drawing software to have students create project plans, have them draw similar triangles using one of the three theorems.

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #7

Ag Power Technology students will add, subtract, multiply and divide real numbers including integral exponents when figuring Ohm's law.

1. Ag Standard

Ag Power Technology, 3.9: Illustrate various electric motor types, operation and maintenance.

- Calculate problems using Ohm's law.

2. Academic Standard

9-12.N.2.1: Students are able to add, subtract, multiply, and divide real numbers including integral exponents.

3. Background Information

Ohm's Law is the foundation of understanding electronics and electricity. The diagram below shows all of the equations and relationships between power (represented by a P, measured in watts), voltage (represented by an E, measured in volts), current (represented by an I, measured in amps), and resistance (represented with an R, measured in ohms).

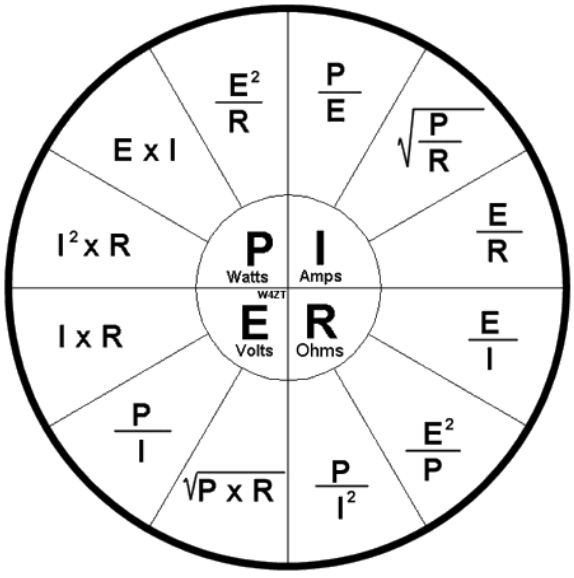


Image retrieved from: http://fixitnow.com/wp-content/uploads/2009/03/ohmspie-450x450.gif on July 27, 2011.

Some of the equations used in Ohm's Law include **Integral Exponents.** Integral exponents are written with a base number and an exponent. For example in 4^2, 4 is the base and 2 is the exponent. What 4^2 actually represent is 4 * 4, which equals 16.

4. Example In Context

The radio in a tractor with a resistance of 30 ohms has a current of 0.1 amps flowing through it. Calculate how much power must be supplied to make it work.

Identify what we know. I = 0.1 amps, R = 30 ohms, we want to find P.

Identify the equation to use. $P = I^2 * R$

Plug I and R into the equation to solve for P.

$P = 0.1^2$ amps * 30 ohms

Following algebraic order of operation (Parenthesis – Exponents – Multiply – Divide – Add – Subtract) continue the calculation.

P = 0.01 * 30

P = 0.3 watts

5. Guided Practice Exercises

Assume a student needs to replace a headlight on a Farmall Super M. When she went to the tractor supply dealership, she was given a 35 watt bulb. She knows the battery in the tractor is 12 volts. What does the resistance of the bulb need to be for it to work properly?

First, identify what we know. P = 35 watts, E = 12 volts, we want to find R (ohms)

Identify the equation that will work for the information we are given. $R = E^2/P$

Plug in the information. $R = 12^2/35$

Following algebraic order of operation (Parenthesis – Exponents – Multiply – Divide – Add – Subtract) continue the calculation. R = 144/35

R = 4.1 Ohms. The bulb must have a resistance of 4.1 ohms to work properly.

6. Independent Practice Exercises

Assume a student is installing a corn planter monitor on a tractor. The tractor has 2 - 6 volt batteries and the monitor has a resistance of 50 ohms. How much power will the monitor need to run properly?

Answer: 2.88 watts($P = E^2/R$, E = 12 volts (the 2 – 6 volt batteries add together for a total of 12 volts, R = 50 ohms, $P = 12^2/50$, P = 144/50, P = 2.88)

Assume a student is replacing one of the monitors on a tractor console. What is the resistance needed in this circuit if it is a 15 watt, 2 amp monitor?

Answer: 3.75 ohms ($R = P/I^2$, $R = 15/2^2$, R = 15/4, R = 3.75 ohms)

7. Notes

None

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #8

Fundamental Ag Mechanics students will be able to use proportions to solve agricultural mechanic problems.

1. Ag Standard

Fundamental Ag Mechanics 3.1: Create sketches of agricultural equipment.

- Utilize drawing techniques to develop a simple sketch.
- Use scale measurement and dimension to develop simple plans and sketches.

2. Academic Standard

9-12.G.2.3: Students are able to use proportions to solve problems (Application).

3. Background Information

Proportions use ratios to help find the equality between two numbers. A proportion can be written as a/b = c/d. Proportions are used typically to solve for an unknown, c or d.

4. Example In Context

Assume a hay wagon has a floor plan with a length of 20 feet and a width of 10 feet. This wagon is sketched onto a piece of paper and when you measure the length with a ruler it is 5 inches. What would be the width of the wagon at that scale?

Identify what we know. A 20 foot line is sketched to 5 inches on paper.

We want to find how many inches a 10 foot line would be on that sketch to keep it to scale.

The value we want to find is represented by an x. We can set up a ratio in our a/b = c/d. It would look like this 20 feet/5 inches = 10 feet/x inches.

Cross multiply. $\frac{20 \text{ feet}}{5 \text{ inches}} = \frac{10 \text{ feet}}{x \text{ inches}}$

To get: $20x = 50$

Following algebraic rules, get x alone. To do that, divide both sides by 20. $\frac{20x}{20} = \frac{50}{20}$

This gives us: x = 2.5 inches

The width of the wagon would be 2.5 inches on the sketch to keep it to scale with the length drawn at 5 inches. (Note: this is a ¼ inch = 1 foot scale)

5. Guided Practice Exercises

Assume a wood feed bunk is 8 feet long by 2 ½ feet wide. What would be the length and width on a ½ inch = 1 foot scale?

Identify what we know. The scale we want to go to is ½ inch is equal to one foot. We know the bunk is 8 feet long and 2 ½ feet wide.

We want to find out how long an 8 foot and a 2 ½ foot line would be on a ½ inch = 1 foot scale.

This is a two part problem because we need to figure how long two different lines would be, the 8 foot and the 2 ½ foot lines.

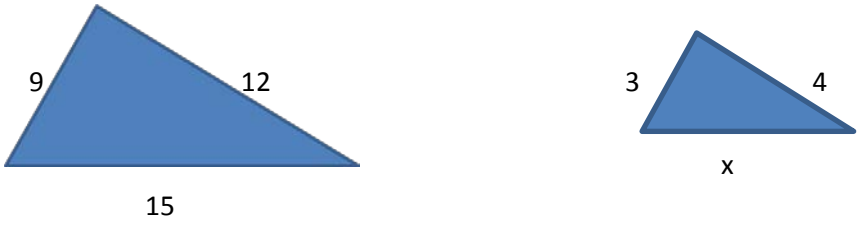
	For the 8 foot line	For the 2 ½ foot line
Set up the ratio: a/b = c/d	1 foot/ ½ inch = 8 feet/x inches	1 foot/½ inch = 2 ½ foot/x inches
Cross Multiply	$\frac{1\text{ foot}}{\frac{1}{2}\text{ inch}} = \frac{8\text{ feet}}{x\text{ inches}}$	$\frac{1\text{ foot}}{\frac{1}{2}\text{ inch}} = \frac{2\frac{1}{2}\text{ foot}}{x\text{ inches}}$
To get	1x = 4	1x = 1.25
Get x alone	$\frac{1x}{1} = \frac{4}{1}$	$\frac{1x}{1} = \frac{1.25}{1}$
x =	x = 4 inches	X = 1.25 inches
Answer	*An 8 foot length is 4 inches*	*A 2 ½ foot width is 1.25 inches*

6. Independent Practice Exercises

Assume you are given a toy farm tractor at a 1/8 inch equals 1 foot scale. When you measure the toy tractor it is 2 inches from where the wheels touch the desk to the top of the cab. How tall would the actual tractor be if it is exactly proportional to the 1/8 inch scale?

Answer: 16 feet (1/8 inch = 2 inch , 1/8x = 2, divide both sides by 1/8, x = 16)
1 foot x feet

Assume the sketches of the two metal brackets below are proportional to each other. What is the value of x?



Answer: 5 (multiple options of how to solve, one is 9/3 = 15/x)

7. Notes

The Fundamental Ag Mechanics teacher could have students use a drafting scale to further enhance understanding of proportions.

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #9

Fundamental Ag Structures Technology students will be able to apply the properties of triangles and quadrilaterals to find unknown parts of wall, joist, and rafter designs.

1. Ag Standard

Fundamental Ag Structures Technology 4.1: Assemble components of a structure.

- Construct a wall.
- Construct a floor joist.
- Erect a rafter.

2. Academic Standard

9-12.G.1.1: Students are able to apply the properties of triangles and quadrilaterals to find unknown parts (Application).

3. Background Information

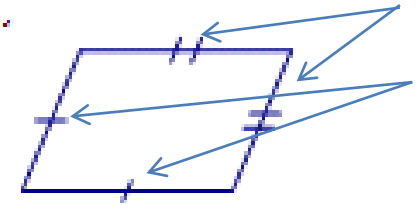
Triangles have a number of properties that apply to all types of triangles. A few of them are:

- The sum of all angles in a triangle is always 180 degrees.
- There can be, at most, only one right or obtuse angle in a triangle.
- An equilateral triangle (all sides the same length) is always equiangular (all angles the same degrees), thus an equiangular triangle is always equilateral.
- Every angle in an equilateral triangle measures 60 degrees.
- If two angles in a triangle are the same degree, the opposite sides are the same length.
- If two sides in a triangle are congruent, the opposite angles are also congruent

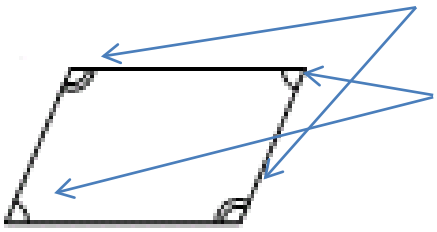
Quadrilaterals are any four sided shape. They too, have properties that apply to all quadrilaterals. They are:

- Must have four sides (or edges).
- Must have four vertices (or corners).
- The interior angles always add up to 360 degrees.

Common signs used on triangles and quadrilaterals



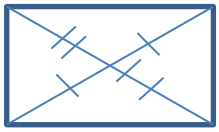
Represents same length: any similar or matching hash marks through a line means they are the same length



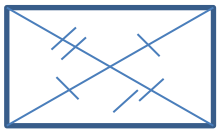
Represents the same angle: any similar or matching marks in the angles of a quadrilateral or triangle means they are the same degree of angle.

4. Example In Context

Assume a student is prefabricating a wall. Prior to sheathing the wall panel she measures diagonally from corner to corner to check if the panel is square. She leaves this sketch for her partner to figure out. Is the wall square? Why or why not?

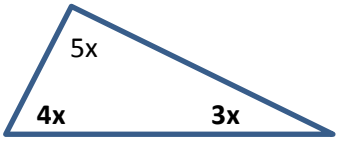


Looking at the marking of the drawings we know the lines with the 2 hash marks are the same length and that the lines with 1 hash mark are the same length. However, the 2 hash and the 1 hash lines are not the same length (or else they would be the same marking as well). Having different lengths of the diagonal measurements would mean that the panel is not square and would need to be adjusted prior to sheathing.



5. Guided Practice Exercises

Assume a student is working with an engineering program to design trusses for a loafing shed. The formula the program gives the student for the trusses is diagramed below. Find the value of x and then find the measure of each angle.



Looking at the truss design above, we can rule out a few properties of triangles. It is not equilateral because it does not have any marks showing us so and the angles are all different. The rule that we do know which applies is that all angles must add up to 180 degrees. So we need to set up an algebraic equation to solve for x.

$3x + 4x + 5x = 180^o$

So $12x = 180$

Next divide both sides by 12 to get x alone: $\frac{12x}{12} = \frac{180}{12}$

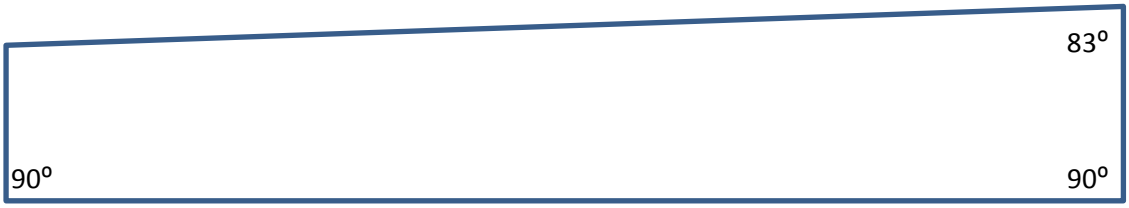
To get: $x = 15$

Now figure out all the angles by plugging 15 in for x.
5(15) = 75
3(15) = 45
4(15) = 60

Check the answers by adding them all up to make sure they equal exactly 180 degrees.
75 + 45 + 60 = 180

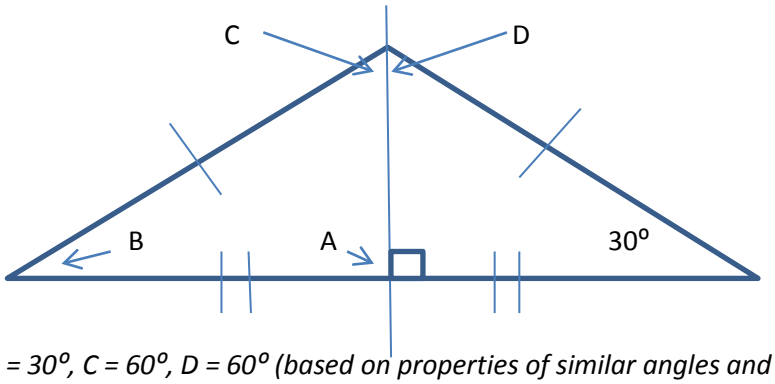
6. Independent Practice Exercises

Assume a student was laying floor joists on pre-marked 16 inch centers, made by another student in the class. When he looked back at his work he began to realize that something did not look right. The only tool he had was a speed square and used it to roughly figure the angles of each corner between the two joists that seemed to not be parallel. Below is the sketch he made. He forgot to mark one of the angles. Find the unknown angle.



Answer: 97° (the angles in a quadrilateral must add up to 360°, 90+90+83= 263, 360-263=97)

Assume a student is designing a rafter system based on the drawing below. Fill in the unknown angles.



Answer: A = 90°, B = 30°, C = 60°, D = 60° (based on properties of similar angles and all triangles add to 180° these angles can be figured out)

7. Notes

A Fundamental Ag Structures Technology teacher could incorporate trigonometry principles to calculate more complex problems in wall construction, floor joist layout, and rafter design to further students' ability to find unknown parts of quadrilaterals and triangles.

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #10

Natural Resources students will be able to predict outcomes of natural random events based on theoretical probabilities.

1. Ag Standard

Natural Resources, NR1.3: Examine planning data to determine natural resource status.

- Collect data to determine resource availability and health of a specific natural resource.
- Analyze resource inventory and population studies of natural resources.

2. Academic Standard

9-12.S.2.2: Students are able to predict outcomes of simple events using given theoretical probabilities (Comprehension).

- Determine the sample space of an experiment.

3. Background Information

Probability

A probability is the likelyhood or chance of something happening in a given experimen.

The formula for theoretical probability of an event is:
P(event) = number of desired outcomes/number of total outcomes

Forexample, the probability of flipping a heads when flipping a coin is ½. On a coin, there are only 2 possible outcomes, heads or tails. The total possible outcomes, 2, is our denominator. The total number possible for our desired outcome of heads, 1, is our numerator. Thus a probability of ½.

Probabilities can be written as a fraction, ½, a ratio 1:2, a percentage 50%, or a decimal 0.5.

Sample Space

The sample space of an experiment is the set of all possible outcomes of the experiment. For example, when flipping a coin, the sample space is: head, tail.

4. Example in Context

Assume 1 out of every 6 eggs laid by a hen pheasant will not fully incubate and hatch. While monitoring a hens nest, a student was able to number eggs as they were laid, 1 through 6, 1 being the first laid and 6 being the last. Find the sample space of this experiment. What is the probability that the last egg laid will not hatch?

First, lets figure out the sample space. We have 6 eggs that we are monitoring to see if they hatch or do not hatch. So our sample space is: egg 1, egg 2, egg 3, egg 4, egg 5, egg 6.

Next figure the probability for each egg to not hatch. If only 1 in every 6 eggs does not hatch, and we have a nest of 6 eggs, each egg has a 1 in 6 chance of not hatching. The probability for each set in our sample space would look like this: egg 1: 1/6, egg 2: 1/6, egg 3: 1/6, egg 4: 1/6, egg 5: 1/6, egg 6: 1/6.

Answer: P(egg 6 not hatching) = 1/6, 1:6, $0.1\overline{66}$, or %16.6.

5. Guided Practice Exercises

Assume a student was cruising an acre of wooded land to identify the types of trees in the area. She identified 27 trees: 7 Boxelder, 9 Black Walnut, 5 Green Ash, and 6 Bur Oak. Identify the sample space of this acre of land. If a single tree is randomly hit and killed by lightning in a storm, what is the probability of each type of tree in this surveyed acre being hit?

Sample Space: Boxelder, Black Walnut, Green Ash, Bur Oak

P(Boxelder hit by lightning) = 7/27, 7:27, $.25\overline{9259}$, or %25.9
P(Black Walnut hit by lightning)= 9/27 = 3/9 = 1/3 (be sure to simplify), 1:3, $.\overline{33}$, or %33.3
P(Green Ash hit by lightning) = 5/27, 5:27, $.18\overline{5185}$, or %18.5
P(Bur Oak hit by lightning) = 6/27 = 2/9, 2:9, $.\overline{22}$, or %22.2

6. Independent Practice Exercises

Assume a student sets up a live trap to survey small game animals in a specific habitat. The trap was set out for 30 days and checked each morning. At the end of 30 days, 16 animals had been trapped: 9 prairie dogs, 3 mink, 2 opossum, and 2 raccoons. Identify the sample space of this experiment. What is the probability if the student set up a trap in that space that the next animal they would catch is a mink?

Answer:
Sample Space: Prairie Dog, Mink, Opossum, Raccoon
P(catching mink) = 3/16, 3:16, 0.1875, or %18.75

Assume a student works for a company that mines uranium. The company drilled 127 test holes on a section of land to help identify commercial grade of uranium deposits prior to beginning mining the section. Of the 127 samples taken from the holes, 98 tested positive for uranium. The other 29 samples turned out negative for uranium. Of the 98 positive samples, only 56 were commercial grade. Identify the sample space for this section of land. What is the probability that any random test site on that section of land contained commercial grade uranium?

Answer:
Sample Space: commercial grade uranium, non-commercial grade uranium, no uranium
P(finding commercial grade uranium) =: 56/127, 57:127, .448818897…, or %44.9

7. Notes

A Natural Resources teacher could have students do a simple biodiversity lab where students identify the different types of natural resources (i.e. number of animals, plants, soil type, rock type…) in a given space (like a hula-hoop). Once they collect the data on the different resources and number of each type of resource, they could figure the sample space and probabilities that if one resource was taken from that space at random, what would the probability be for each type of resource to be removed?

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #11

Wildlife Fisheries students use linear and nonlinear models to solve problems related to fish and wildlife management by comprehending population information.

1. Ag Standard

Wildlife Fisheries, WF 1.1: Apply knowledge of natural resource components to the management of wildlife and fish.

- Dramatize predator and prey population relationships.
- Illustrate the interdependence of organisms within an ecosystem.

2. Academic Standard

9-12.A.3.2: Students are able to distinguish between linear and nonlinear models. (Comprehension)

3. Background Information

Linear models are a function of a linear equation. When graphed onto an x, y axis they form a straight line. They will always conform to the equation y = mx +b, where m = slope (rise/run), x = variable, and b = y-intercept.

Nonlinear models are functions of non-linear equations like quadratic or cubic equations. When graphed on an x, y axis they form curved lines. Nonlinear equations will include numerical exponents. For example a quadratic equation looks like $y = ax^2 + bx$, notice the ax raised to the power of 2. The 2 is our exponent. A cubic equation looks like $y = ax^3 + bx^2 + cx$, notice the ax is raised to the 3^{rd} power (3 is the exponent) and bx is raised to the 2^{nd} power (2 is the exponent).

4. Example in Context

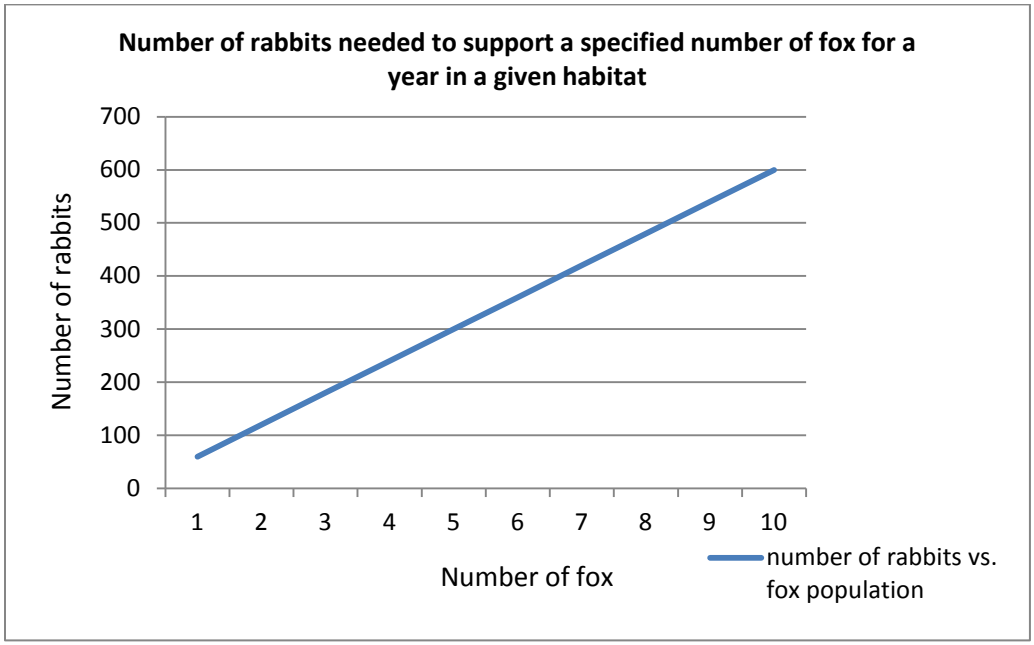
Assume in a habitat that for each fox to live for a year, it needs to consume 60 rabbits. We can express this as r (rabbit population) = 60 (number of rabbits each fox needs to eat) x f (the number of fox in the habitat) to figure out the relationship between rabbit population and fox population. Create a graph that illustrates the number of rabbits needed to carry 1 through 10 fox in that habitat for a given year.

The equation we need is given to us: r = 60f

If we plug in the number of foxes, 1 through 10, we get the chart below.

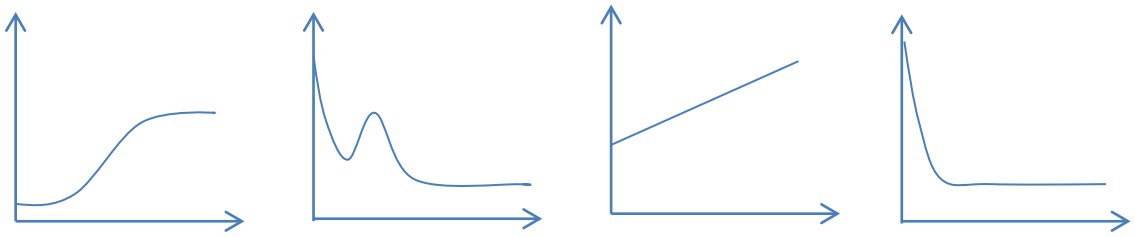
Number of fox (f)	Plug into equation	Number of rabbits needed (r)
1	r = 60(1)	60
2	r = 60(2)	120
3	r = 60(3)	180
4	r = 60(4)	240
5	r = 60(5)	300
6	r = 60(6)	360
7	r = 60(7)	420
8	r = 60(8)	480
9	r = 60(9)	540
10	r = 60(10)	600

Graphing this data, we get a linear graph as illustrated below.



5. Guided Practice Exercises

Assume a student is given the following four charts illustrating the annual population of a species of fish based on algae blooms. Which of the illustrations represents a linear relationship throughout the year?



1 2 3 4

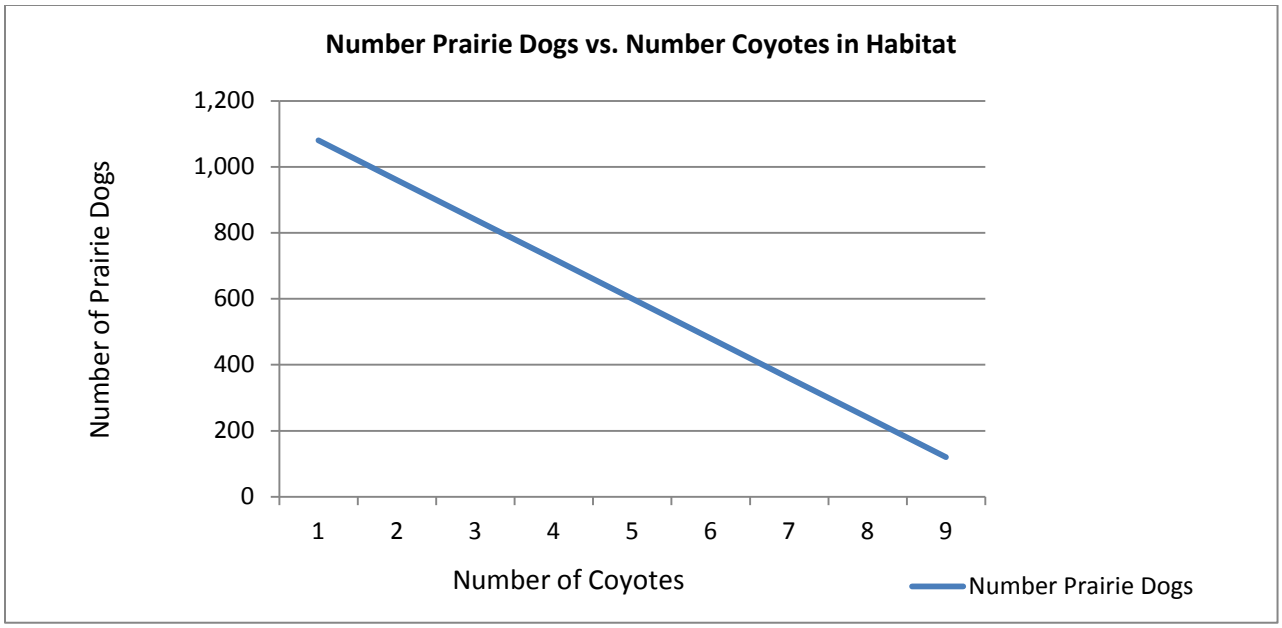
Answer: 3(it is the only line that is entirely linear)

6. Independent Practice Exercises

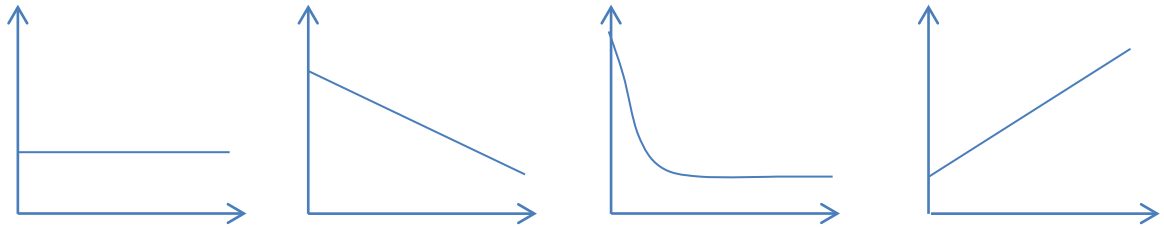
Assume that in a given habitat 1,200 prairie dogs were living. They had no predators in this habitat. The South Dakota Department of Game, Fish, and Parks (SDGFP) decided to introduce coyotes into this habitat to decrease the population of prairie dogs. The SDGFP was told that for each coyote they released, it would decrease the population of prairie dogs by 120 annually. They figured this equation y (decrease in prairie dog population) = -120 x (number of coyotes introduced to the habitat), or y = -120x. Create a graph that illustrates how many coyotes it would take to bring the population of prairie dogs below 200 starting with 1 coyote.
(Note: you will have to add an extra step to figure the population after each coyote is introduced because you are starting with a given population and decreasing it with each coyote)

Answer:

Number of coyotes(x)	*Plug into equation*	*Decrease in prairie dog population(y)*	*Number of Prairie Dogs (1,200 + y)*
1	*y = -120(1)*	*-120*	*1,080*
2	*y = -120(2)*	*-240*	*960*
3	*y = -120(3)*	*-360*	*840*
4	*y = -120(4)*	*-480*	*720*
5	*y = -120(5)*	*-600*	*600*
6	*y = -120(6)*	*-720*	*480*
7	*y = -120(7)*	*-840*	*360*
8	*y = -120(8)*	*-960*	*240*
9	*y = -120(9)*	*-1,080*	*120*



Assume a student was given the following 4 graphs illustrating the population of pheasant in a habitat compared to the population of bobcat. Which graph is nonlinear?



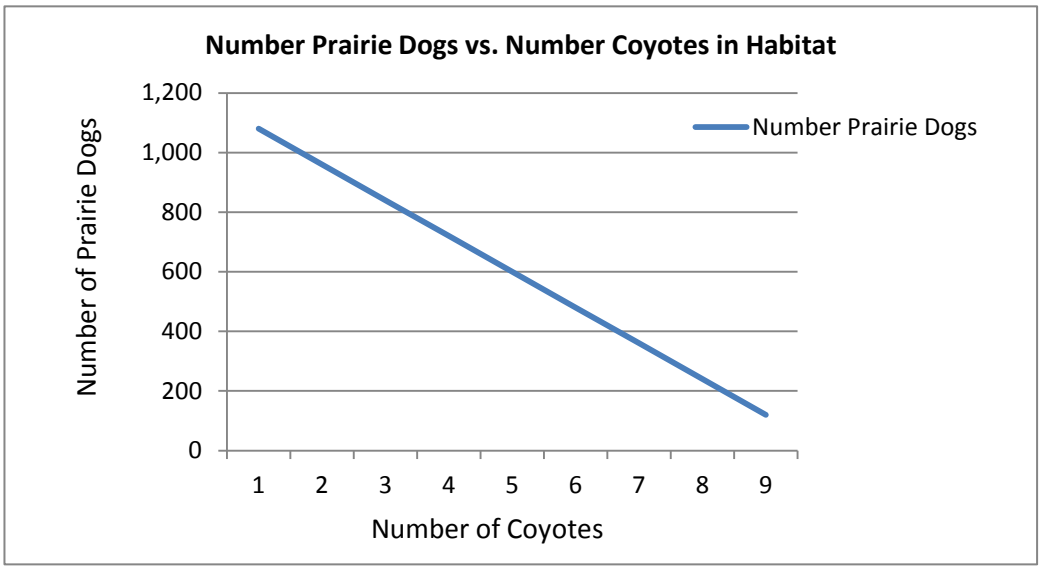
1 **2** **3** **4**

Answer: 3(it is the only one that does not form a straight line)

7. Notes

A Wildlife and Fisheries teacher could share carrying capacity charts and discuss the type of graphic model used in the illustration to further students' understanding of linear and nonlinear models.

Number Prairie Dogs
1,080
960
840
720
600
480
360
240
120



South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #12

Agribusiness Sales and Marketing students will be able to identify and use real numbers when interpreting inventory and calculating product margins.

1. Ag Standard

Agribusiness Sales and Marketing, ABSM 3.1: Apply reading comprehension, writing and math skills in inventory management.

- Calculate product margin (specifically net profit).
- Interpret inventory control systems.

2. Academic Standard

9-12.N.1.1: Students are able to identify multiple representations of a real number. (Comprehension)

- Given a real number, identify the subset(s) of real numbers to which it belongs.
- Represent rational and irrational numbers in different forms.

3. Background Information

Real numbers can be written in many forms like natural numbers, whole numbers, integers, and rational numbers. Irrational numbers also exist and knowing their definition may help explain real numbers.

Natural Numbers

Natural numbers are also known as counting numbers. Starting at 1 and continuing forever. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 …

Whole Numbers

Whole numbers are all the natural numbers plus zero. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 ….

Integers

Integers are all the whole numbers plus the negatives. …-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5…

Rational Numbers

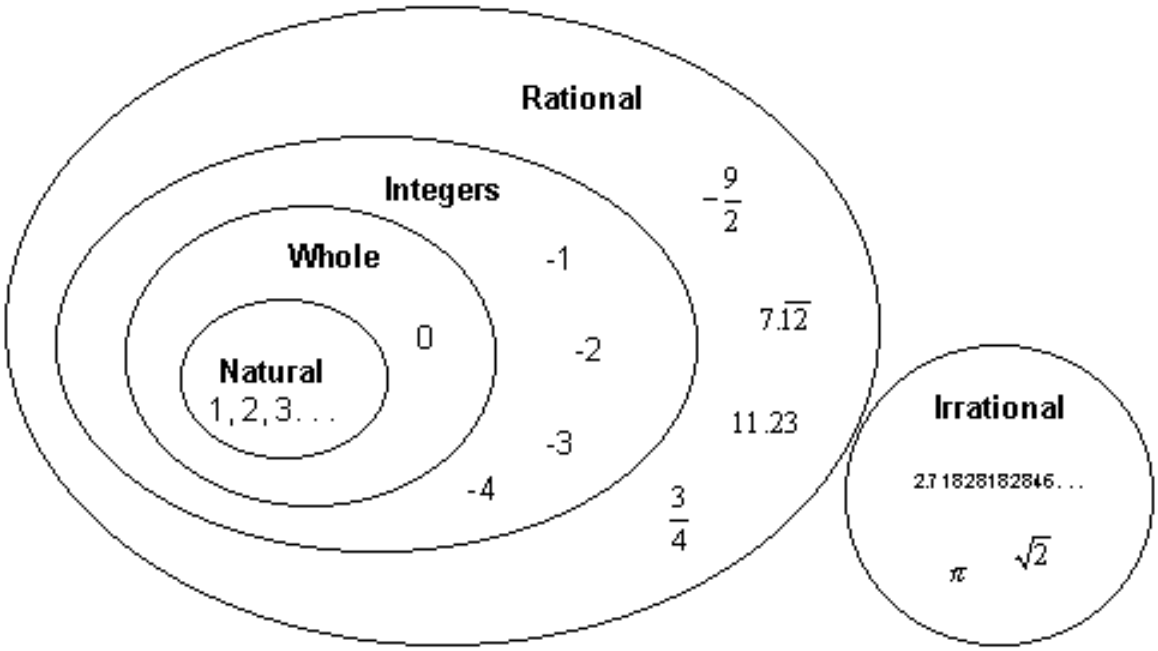
Rational numbers can be put into the formula a/b, where a and b are both integers and b is not zero. We often refer to rational numbers as fractions. In the fraction a/b, a is the numerator and b is the denominator. Fractions can be smaller than 1, like ½, or larger than 1, like 5/2 which can be simplified to 2 ½. All integers can be thought of as rational numbers as well, with a denominator of 1, like 3 being written as 3/1. Rational numbers as a decimal will always hit a repeating pattern, like $1.6\overline{6}$ or $2.124\overline{124}$, or will end, like 3.75 or 6.2.

Irrational Numbers

Irrational numbers cannot be expressed as a ratio of integers and in decimal form will never end or find a repeating pattern. For example, π or √2. These numbers as decimals never end.

Below is an image to help visualize how the real number system works.

Image from: http://www.jamesbrennan.org/algebra/numbers/real_number_system.htm Retrieved July 25, 2011.



4. Example in Context

Assume a student is working for an agricultural mail order company. That student is handed a print out from the inventory control system of current inventory on hand and a current list of orders to be shipped. They need to figure if they can fill the orders and how many items will remain after this order is filled. Based on the data given, would they be able to fill all of the orders?

Item	Current Inventory	Current Orders	Availability After Order	Identify the type of Real Number
Shoulder length gloves	12652 boxes	689 boxes		
XL rubber boots	389 pair	58 pair		
L rubber boots	134 pair	79 pair		
M rubber boots	23 pair	65 pair		
XL latex gloves	987 boxes	755 boxes		
L latex gloves	345 boxes	566 boxes		

Answer: No, the student would be able to fill all of the orders except the M rubber boots and the L latex gloves. They would be (short) -42 pairs of M rubber boots and (short) -221 boxes of L latex gloves. See chart below for complete answers.

Item	Current Inventory	Orders to Fill	Availability After Order	Identify the type of Real Number
Shoulder length gloves	12652 boxes	689 boxes	11963	Natural
XL rubber boots	389 pair	58 pair	331	Natural
L rubber boots	134 pair	134 pair	0	Whole
M rubber boots	23 pair	65 pair	-42	Integer
XL latex gloves	987 boxes	755 boxes	232	Natural
L latex gloves	345 boxes	566 boxes	-221	Integer

5. Guided Practice Exercises

Assume a student was just hired to sell windmill turbines and was given a handbook with the capacity levels of different turbines. The chart for each turbine's capacity is below. As part of the orientation, the sales people meet with the engineers to help understand the products. The first thing the engineer asks is which of these numbers is actually rational?

Item	Capacity
Turbine 1	2√2
Turbine 2	π
Turbine 3	√4
Turbine 4	5.121221222…

Answer: √4 is the only rational number as it simplifies to 2.

Item	***Capacity***	***Simplified***	***Type of Number***
Turbine 1	*2√2*	*2.828427125…*	*Irrational*
Turbine 2	*π*	*3.14159265…*	*Irrational*
Turbine 3	*√4*	*2*	*Rational*
Turbine 4	*5.121221222…*	*5.121221222…*	*Irrational*

Assume a student works at a local tractor dealership. At the end of the year they were asked to figure the net profit margin (Net income after taxes ÷ Revenue = Net Profit Margin) on a specific model of tractor. The net income after taxes on that specific model of tractors sold was $130,000, the revenue was $747,000. What is the net profit margin? Is this a real number?

Take the net income after taxes and divide it by the revenue.

$130,000/$747,000 = .174029451…

It does not end or repeat, so it is not a real number, it is irrational.

Answer: .174029451… not a real number (note, net profit margin is often expressed in a %, in this case the net profit margin would likely be expressed at %17.4)

6. Independent Practice Exercises

Assume a student began a business selling toy tractors online. At the end of the year he wanted to figure out his net profit margin. His net income after taxes was $1,500 and he had revenue of $6,000. What was his profit margin? Is this a real number?

Answer: 0.25 or %25, this is a real number, more specifically a rational real number.

Assume a student works at a local hardware store that sells both in store and online. They were given an inventory print out of some of the nuts and bolts and then given a print out of online orders

that needed to be filled. Will the student be able to fill all of the orders with the current inventory? If not, which ones can be filled and which ones cannot? What type of numbers is the student working with?

Item	Current Inventory	Orders to Fill
½ inch nuts	789	1,233
½ inch x 3 inch bolts	917	917
¼ inch nuts	780	600
¼ inch x 3 inch bolts	89	120
½ inch lock washers	121	100
½ inch flat washers	1,225	1,000
¼ inch lock washers	2,255	900
¼ inch flat washers	956	950

Answer: The student will not be able to fill all of the orders. The ½ inch nuts and the ¼ inch x 3 inch bolts will be short. See chart for complete set of answers

Item	*Current Inventory*	*Orders to Fill*	*Availability After Order*	*Identify the type of real number*
½ inch nuts	*789*	*1233*	*-444*	*Integer*
½ inch x 3 inch bolts	*917*	*917*	*0*	*Whole*
¼ inch nuts	*780*	*600*	*180*	*Natural*
¼ inch x 3 inch bolts	*89*	*120*	*- 31*	*Integer*
½ inch lock washers	*121*	*100*	*21*	*Natural*
½ inch flat washers	*1,225*	*1000*	*225*	*Natural*
¼ inch lock washers	*2,255*	*900*	*1,355*	*Natural*
¼ inch flat washers	*956*	*950*	*6*	*Natural*

7. Notes

None

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #13

Agribusiness Entrepreneurship students will be able to comprehend equivalent forms of algebraic expressions when studying supply and demand curve formulas.

1. Ag Standard

Agribusiness Entrepreneurship, E 1.2: Develop management skills necessary to accomplish general business activities.

- Illustrate basic economic concepts to a given set of financial situations including opportunity cost, supply and demand and diminishing returns.

2. Academic Standard

9-12.A.1.1: Students are able to write equivalent forms of algebraic expressions using properties of the set of real numbers (Comprehension).

- Evaluate algebraic expressions.
- Use conventional order of operations.

3. Background Information

When **evaluating simple algebraic expressions**, all unknows (typically expressed as a letter) are replaced with real numbers. For example, 3x + 2x when x = 5. Plug in 5 for x to get 3(5) + 2 (5) = 15 + 10 = 25

The **order of opperations** for algebraic equations follow this sequence: Parenethesis – Exponents – Multiply – Divide – Add – Subtract.

4. Example in Context

Assume a student is given the equation for a demand line to be p = -1x +25 where p represents price per item sold and x is the number of items sold at that price. What would the ideal price need to be for a company to make and sell 20 items.

Plug 20 in for x and solve for p

p = -1(20) + 25
p = -20 + 25

p = $5

5. Guided Practice Exercise

Assume a student is given the equation for a supply curve to be p = 2x +5 where p represents price per item sold and x is the number of items sold at that price. What would be the price needed for a company to make and sell just one item.

Plug 1 in for x and solve for p
p = 2(1) + 5
p = 2 + 5
p = $7

6. Independent Practice Exercises

Assume a student is analyzing a demand curve for a business selling hay bales. They would like to know the quantity (x), of hay bales that could be sold at a price (p) of $25 per bale. The equation for the graph is p =- 2(x) + 35.

Answer: 5 bales (p = -2(x) + 35, 25 = -2x +35, 25 – 35 = -2x = 35 – 35, -10 = -2x, $\frac{-10}{-2} = \frac{-2x}{-2}$, x = 5)

Assume a student is given the equation for a supply curve for a sweet corn stand as p = .025x + 1. They would like to know the ideal price if they wanted to sell 144 dozen sweet corn in one day at a farmers market. What would that price be per dozen?

Answer: $4.60 (p = .025(144) + 1)

7. Notes

None

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #14

Agriscience students use alternative computation strategies to quickly find units of seed needs for a given field and seeding rate recommendation.

1. Ag Standard

Agriscience, AS2.2: Demonstrate plant cultural procedures.

- Demonstrate proper seeding practices.

2. Academic Standard

9-12.N.3.2: Students are able to select alternative computational strategies and explain the chosen strategy.

3. Background Information

Reducing is a strategy to compute large numbers in an equation, especially those where multiplication or division is required. Reducing requires that all numbers in the equation can be divided by the same, easy to remember number, such as 5, 100, or 1,000. Reducing makes it easier to computer equations with mental math. It's important to remember that in the equations, you have to compute the number used to reduce the equation, too, and combine back with the result to get the final answer.

Example: *800 X 200 = n*

- → Reduce by 100
- → 8 X 2 = n and 100 X 100
- → n=16 and 100 x 100 = 10000
- → Multiple the two results
- → Answer is 16,000

Example: *140 / 20 = n*

- → Reduce by 10
- → 14 / 2 = n and 20 / 20
- → n=7 and 20 /20 = 1
- → Multiple the two results
- → Answer is 7

Sometimes, when multiplying or dividing a large number by a smaller number, you may not be able to reduce both numbers in the equation, but you can factor out the larger number into two smaller numbers to make the mental computation easier.

Example: *800 X 2 = n*

- → 800 can be factored in 8 and 100
- → Reduce to 8 / 2 = n and recall that the answer needs to be multiplied by 100

→ n=4
→ Multiple the factor of 100
→ Answer is 400

4. Example in Context

Example:
A farmer is going to plant a 160 acre field to corn this year. The recommended seeding rate for this field is 20,000 seeds per acre. A unit (bag) of seed corn contains 80,000 seeds. Using mental math strategies, how many units of corn seed are needed for the field?

Answer:
This is a two stage computation.
In the first stage, find the number of acres one bag of seed can plant.
80,000 / 40,000 = n
Reduce all numbers by 10,000
8 / 4 = n and 10,000 / 10,000
n = 2 and 10000 / 10000 = 1
Multiple results together
2 X 1 = 2 acres per unit of seed

In stage two, take the number of acres and divide by the number of acres each unit of seed will plant to find the number of units needed.
160 / 2 = n
160 can be factored in 16 and 10
Reduce to 16 / 2 = n and recall that the answer needs to be multiplied by 10
n=8
Multiple the factor of 10
Answer is 80

The farmer will need to purchase 80 units of seed to plant this field

5. Guided Practice Exercise

Example:
A farmer is going to plant an 80 acre field to soybeans this year. The recommended seeding rate for this field is 100,000 seeds per acre. The seed soybeans used by this farmer are large so only 125,000 seeds are present in a 50 pound bag (one unit). Using mental math strategies, how many units of soybean seed are needed for the field?

Answer:
This is a two stage computation.
In the first stage, find the number of acres one bag of seed can plant.
125,000 / 100,000 = n
Reduce all numbers by 100,000
1.25 / 1 = n and 100,000 / 100,000
n = 1.25 and 100,000 / 100,000 = 1

Multiple results together
1.25 X 1 = 1.25 acres per unit of seed

In stage two, take the number of acres and divide by the number of acres each unit of seed will plant to find the number of units needed.
80 / 1.25 = n
80 can be factored in 8 and 10
Reduce to 8 / 1.25 = n and recall that the answer needs to be multiplied by 10
(8 / 1.25 may require estimation strategies or quick written equation to solve)
n=6.4
Multiple the factor of 10
Answer is 64

The farmer will need to purchase 64 units of seed to plant this field

6. Independent Practice Exercises

Example:
A farmer is going to plant 2000 acres of corn this year. The recommended seeding rate, on average for the farm, is 32,000 seeds per acre. A unit (bag) of seed corn contains 80,000 seeds. Using mental math strategies, how many units of corn seed are needed for the field?

Answer:
This is a two stage computation.
In the first stage, find the number of acres one bag of seed can plant.
80,000 / 32,000 = n
Reduce all numbers by 10,000
8 / 3.2 = n and 10,000 / 10,000
(8 / 3.2 may require estimation strategies or quick written equation to solve)
n = 2.5 and 10,000 / 10,000 = 1
Multiple results together
2.5 X 1 = 2.5 acres per unit of seed

In stage two, take the number of acres and divide by the number of acres each unit of seed will plant to find the number of units needed.
2000 / 2.5 = n
2000 can be factored in 20 and 100
Reduce to 20 / 2.5 = n and recall that the answer needs to be multiplied by 100
(20 / 2.5 may require estimation strategies or quick written equation to solve)
n=8
Multiple the factor of 100
Answer is 800

The farmer will need to purchase 800 units of seed to plant this field

7. Notes

As an extension of these exercises, you can have the students find the total cost of seed by using $200 per unit of corn and $300 per unit of soybean seed. This will help students understand the scope of expense incurred by many farmers.

South Dakota Agricultural Education (AFNR)
Academic Integration Activities
ACTIVITY #15

Introduction to Agriculture, Food and Natural Resources students will be able to use lines of symmetry to explain plant cell structure, seed type, and how seeds germinate.

1. Ag Standard

Introduction to Agriculture, Food and Natural Resources, ITA 5.1: Explain functions and physiology of cells and seeds.

- Summarize the cellular structure of plants.
- Explain the structure and kinds of seeds.
- Summarize the process of seed germination.

2. Academic Standard

9-12.G.2.2: Students are able to reflect across vertical or horizontal lines and translate two-dimensional figures (Application).

- Identify lines of symmetry

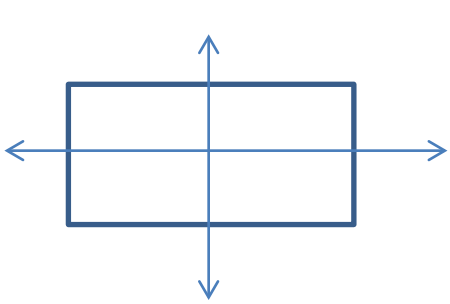
3. Background Information

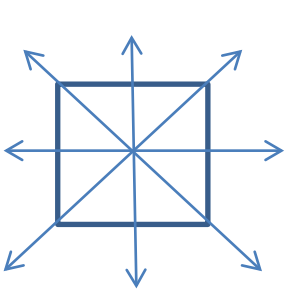
A line of symmetry divides a figure into two congruent (similar or matching) halves.

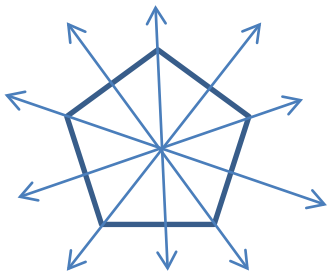
How to find lines of symmetry

1. Look for midpoints in the figure
2. Use a ruler to draw a straight line through the estimated midpoint
3. Fold the shape in half to see if both sides match. If they do, it is a line of symmetry.

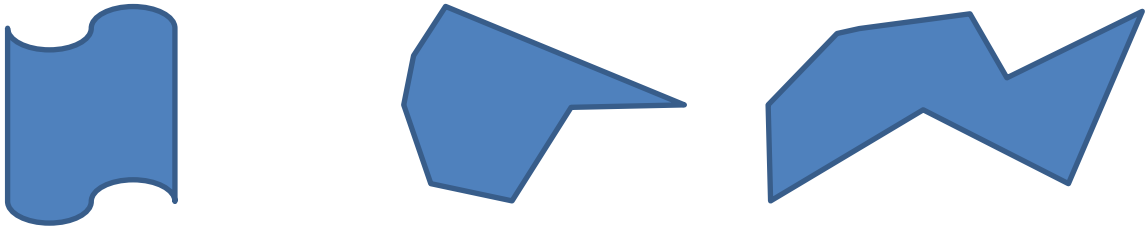
A rectangle has two lines of symmetry because there are two ways to divide the shape into two congruent halves. A square has four lines of symmetry because there are four lines that divide the figure into two congruent halves. A regular pentagon has five lines of symmetry as shown.







There are also shapes that have no lines of symmetry. Here are some examples:



4. Example in Context

Assume students are studying plant cells and take a microscopic look at onion cells to get a closer look of the cell structure. Of the full cells we can see in this view, how many lines of symmetry would there be?

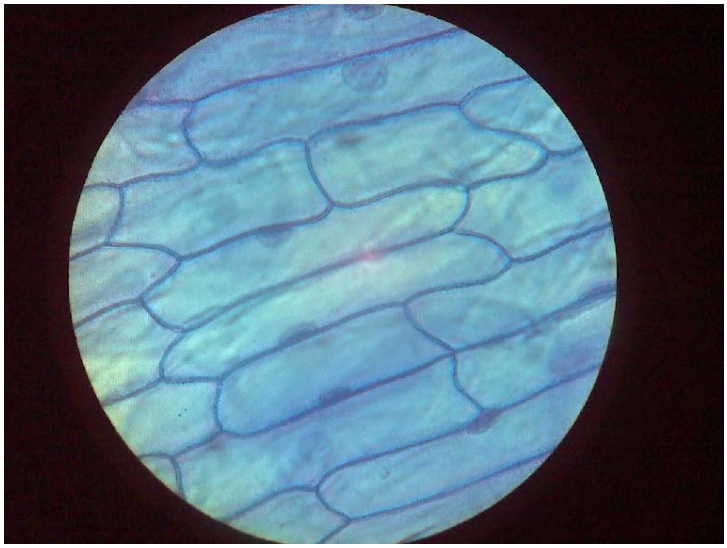
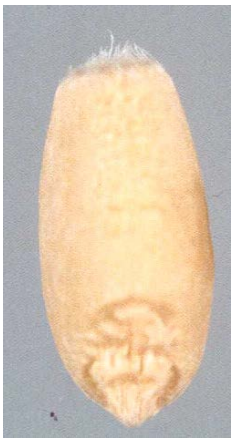


Image from: http://schools.nashua.edu/myclass/marshalll/biohn/Pictures/onion-cells_close-up2.jpg, retrieved: July 28, 2011.

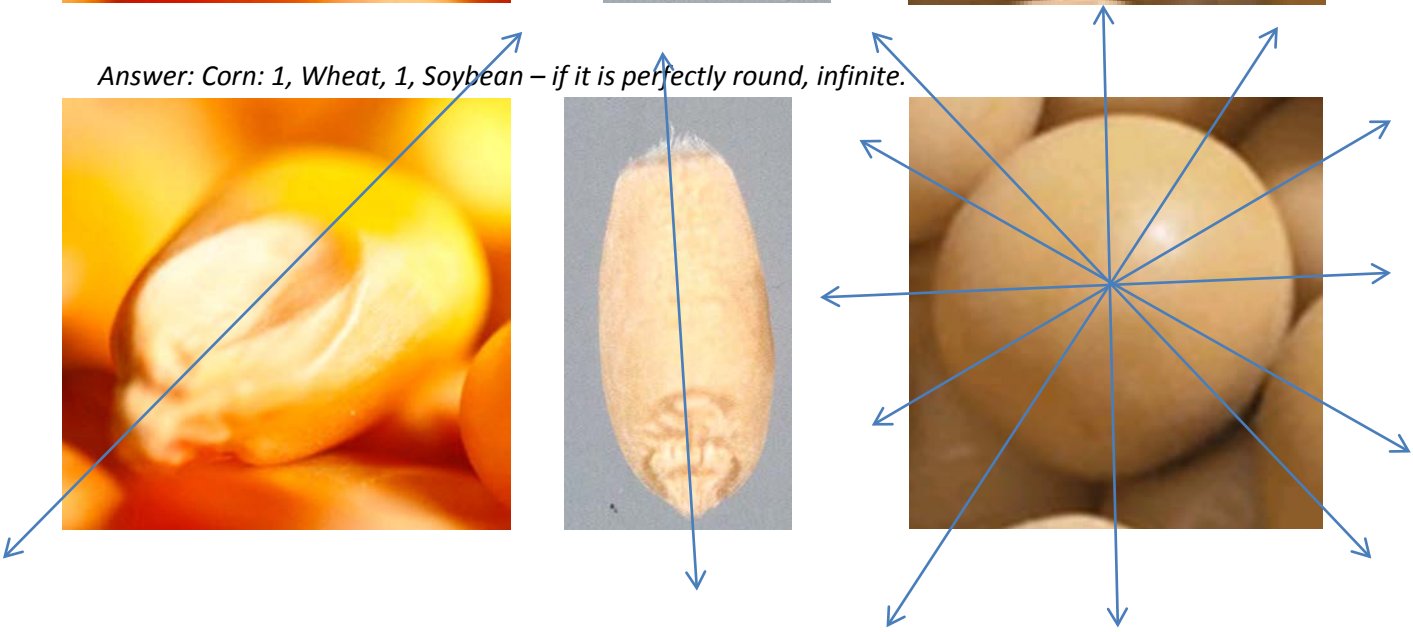
Answer: None. These onion cells do not have lines of symmetry.

5. Guided Practice Exercise

Assume students are studying different kinds of seeds. How many lines of symmetry could they find on the corn, wheat, and soybean seed?


Answer: Corn: 1, Wheat, 1, Soybean – if it is perfectly round, infinite.



6. Independent Practice Exercises

Assume students are studying monocot (corn) and dicot (bean) germination. After studying the images below, when is the only time during the germination process where all parts of the plant would have one or multiple lines of symmetry?

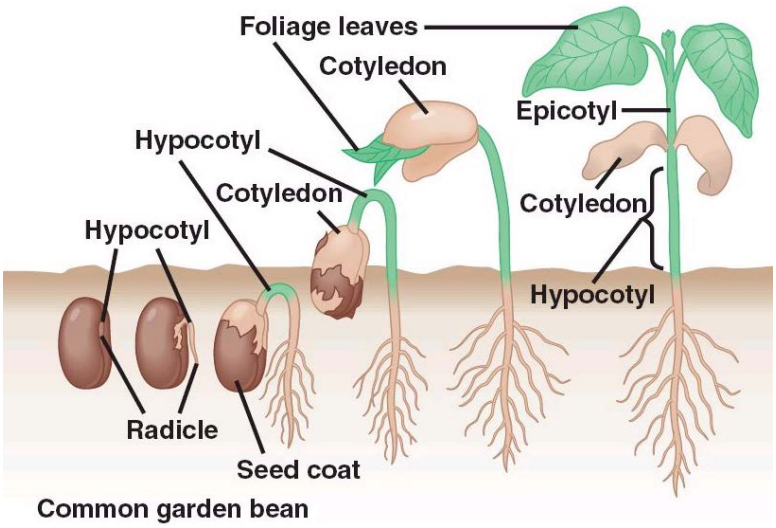


Image from: http://bio1152.nicerweb.com/Locked/media/ch38/38_10SeedGermination-dicot.jpg retrieved: July 28, 2011

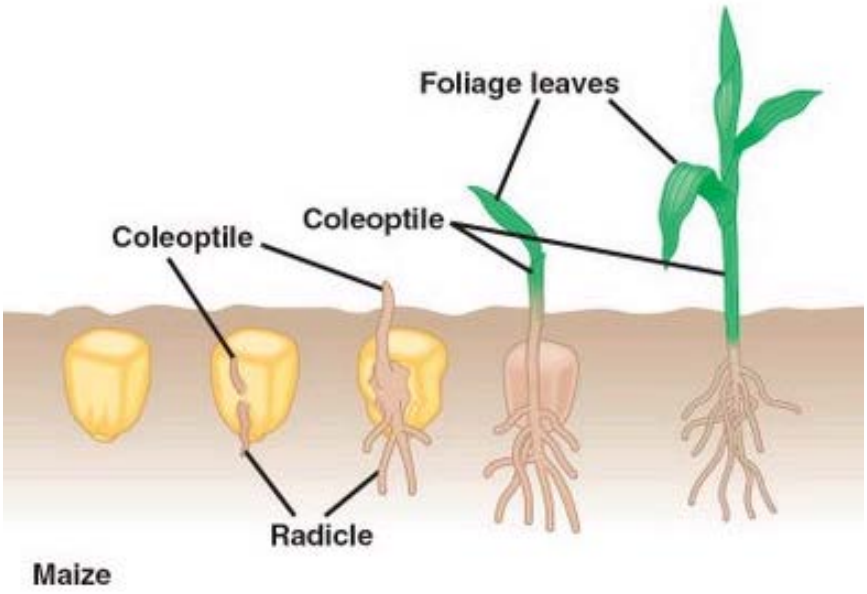


Image from: http://2.bp.blogspot.com/__tSSv1655kc/SgJb23aiQGI/AAAAAAAAAEw/2JyDkLy4JMs/s400/38_10SeedGermination-monocot.jpg Retrieved, July 28, 2011

Answer: While it is still a seed.

Assume the sunflower below was cut in half along a line of symmetry. Draw the congruent side of the sunflower.

Answer: an image similar to the one below

Image from: http://farm2.static.flickr.com/1399/1084445061_993666e8a8.jpg retrieved July 28, 2011

7. Notes

Lines of symmetry can be found naturally in plants and could be used to teach geometry in a variety of ways. They could be used to classify plants, leaves, seeds, or identify steps of mitosis.